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Soil Survey

of

Brown County, Wisconsin

By

A. C. ANDERSON, in Charge
W. J. GEIB, and M. J. EDWARDS
United States Department of Agriculture

and

M. B. WHITSON, C. E. BORN, and HAROLD BANDOLI
Wisconsin Geological and Natural History Survey

Bureau of Chemistry and Soils

In cooperation with the
Wisconsin Geological and Natural History Survey
and the University of Wisconsin College of Agriculture

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H. L. RUSSELL, *Dean*
A. R. WHITSON, *in Charge Soil Survey*

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[1] Names of soil types in parenthesis are those used for the particular soil by the State.

SOIL SURVEY OF BROWN COUNTY, WISCONSIN

By A. C. ANDERSON, in Charge, W. J. GEIB, and M. J. EDWARDS, United States Department of Agriculture, and M. B. WHITSON, C. E. BORN, and HAROLD BANDOLI, Wisconsin Geological and Natural History Survey

COUNTY SURVEYED

Brown County is in the east-central part of Wisconsin. (Fig. 1.) The head of Green Bay extends into the northeastern corner of the county, which is irregularly rectangular in shape and covers an area of 529 square miles, or 338,560 acres.

The county consists largely of a glacial till plain somewhat modified by erosion but still predominantly constructional, except where features of the preglacial terrane dominate the relief.

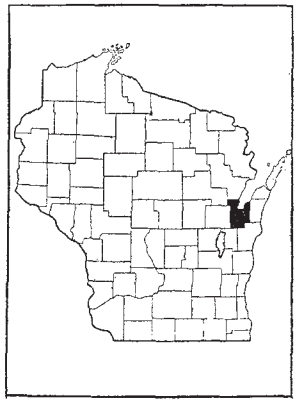

FIGURE 1.—Sketch map showing location of Brown County, Wis.

Five belts, or physiographic divisions, extend across the county from southwest to northeast, parallel with Fox River and the Niagara Escarpment, as follows: (1) An undulating or rolling till plain in the southeastern half of the county (2) a narrow strip of hilly broken land along the Niagara Escarpment, extending from the southwestern corner to the northeastern corner, (3) a belt of level terraces (Fox River Valley) along Fox River and Green Bay, (4) a series of ill-defined benches and eroded slopes about 2 miles wide west of Fox River Valley, including many sandy benches and old beach lines, and (5) a level to undulating till plain or shallow old lake bottom in the northwestern corner of the county.

The surface relief is modified by the underlying rock.[2] The rocky ledge known as the Niagara Escarpment, is a westward-facing escarpment steep at the top but grading at the foot of the steep slope of bare magnesian limestone into a belt of low hills, a mile or more wide, which grade in turn into the low plain west of and below the escarpment. It extends from north to south across the county about 4 miles east of Fox River for a long distance, approaching Green Bay in the northeastern part of the county. The most prominent part extends northeastward from Greenleaf for a distance of 10 miles, where the highest part is about 150 feet above the floor of the Fox River Valley. The rocky ledge at the top is missing for a distance of 8 miles from a point near Kolb northeastward toward Bay Settlement. This gap includes deeply eroded slopes and high deeply dissected benches cut by narrow valleys to a depth of about 75 feet. It includes much sandy and gravelly outwash material south of Ellis Creek.

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[2] MARTIN, L. PHYSICAL GEOGRAPHY OF WISCONSIN. Wis. Geol. and Nat. Hist. Survey Bul. 6, Ed. Ser. 4, 549 p., illus. Madison, Wis. 1916.
ALDEN, W. C. THE QUATERNARY GEOLOGY OF SOUTHEASTERN WISCONSIN, WITH A CHAPTER ON THE OLDER ROCK FORMATIONS. U. S. Geol. Survey Prof. Paper 106, 356 p., illus. 1918.

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Bedrock lies at a slight depth, and the surface of the land is level eastward from the top of the Niagara Escarpment, especially in the northeastern corner of the county, but toward the southeast, the depth to bedrock gradually increases and the relief is more rolling. An area between Denmark and Wayside, in the southeastern corner of the county, a part of the Kettle Range, is very hilly and distinctly morainic. Many poorly drained depressions occur in this locality, but the rest of the southeastern half of the county has a fairly complete drainage system. The stream bottoms are young and narrow, and the streams have cut to a depth ranging from about 10 to 25 feet. A narrow belt along Neshota River north of Denmark is more deeply dissected, and the Neshota River bottom lies about 75 feet below the level of the region.

The known elevations[3] in this belt range from 759 feet at Bellevue to 791 feet at Summit School, 809 feet at New Franken, and 874 feet at Denmark. A few points on the ridges are somewhat higher, and in the stream valleys there are somewhat lower elevations.

The Fox River Valley is a nearly smooth area extending to a distance of 2 or 3 miles from each bank of Fox River. It has an even slope to the northeast and also toward the river, and most of it is fairly well drained. The river channel is remarkably straight and is cut from 25 to 50 feet below the level of the valley. The valley becomes more flat in the northern part of the county, and a small area at the head of Green Bay is marshy. A flat bench, about 2 miles wide and lying from 1 to 5 feet above the water level, occurs along the west side of Green Bay, and an undulating bench lies between Green Bay and the Niagara Escarpment to the east.

The known elevations in this valley range from a mean of 581 feet above sea level at the water level of Green Bay to 590 feet at De Pere, 644 feet at Little Rapids, and 657 feet at Wrightstown. Greanleaf and Askeaton on the eastern upper border of the valley have elevations of 725 feet and 743 feet, respectively.

The northwestern part of the county, between Pulaski, Flintville, and Oneida, is a nearly level plain, very slightly eroded by shallow stream channels and containing some low morainic ridges and low benchlike sandy ridges. Pulaski, with an elevation of 797 feet, and Oneida, with an elevation of 746 feet, are on the general level of the plain.

The region of which Brown County is a part was originally forested, with the exception of some marshy areas along Green Bay. Nearly all the original timber has been cut, and only a few scattered groves, largely of second-growth trees, remain. According to the old settlers and the United States land surveyors' notes, the virgin timber was mixed pine and hardwoods on the uplands, with pine predominating. More hardwoods grew in the southeastern part of the county and more pine and hemlock in the northern part. The areas of Bellefontaine soils in the southeastern corner were covered mainly with hardwoods, including oaks, maple, beech, basswood, hickory, aspen, birch, elm, white ash, butternut, wild plum, black cherry, hawthorn, and ironwood, and there was a comparatively small number of white pine and hemlock. The predominating forest on the large areas of Kewaunee silty clay loam in the southeastern half of the county consisted of

[3] All elevations obtained from the following publication: MARTIN, L. Op. cit.

white pine and some hemlock, with a few scattered hardwoods. Several sections south of Sugarbush were largely covered with sugar maple and beech. The areas of Longrie soils in the northeastern corner of the county were covered with a thin scrubby growth of oak, and the stony Posen soils nearby supported a thick small growth of white pine, Norway pine, balsam fir, largetooth aspen, red maple, quaking aspen, and oak, with an undergrowth of sumac, Juneberries, raspberries, and other shrubs. The belt along the Niagara Escarpment had a similar admixture of trees but with a higher percentage of hickory, butternut, and other hardwoods. The forest cover on the Superior soils in the Fox River Valley was largely white pine mixed with hardwoods and hemlock. The Onaway soils supported a very heavy stand of white pine, with some hemlock and hardwoods. Coloma fine sand and Plainfield fine sand were covered with Norway pine and white pine.

The big fire of 1871 destroyed much of the pine timber in the county. The burned-over areas first grew up to aspen and later to hardwoods. The muck and peat swamps and other poorly drained areas are still forested, for the most part. Cedar, tamarack, black oak, alder, elm, white birch, aspen, and soft maple are the most common trees. Tamarack usually grows on the rather fibrous muck or peat, cedar on the brown well-disintegrated muck, and hardwoods on the black well-disintegrated muck and poorly drained mineral soils. Tahquamenon peat is covered with marsh grasses, together with some rushes, cattails, and other marsh vegetation in places. Kentucky bluegrass and redtop seem to be the most important grasses on well-drained areas.

Green Bay, located on Green Bay in the northern part of Brown County, is one of the oldest settlements of the northwest.[4] Jean Nicollet landed here in 1634, Father Claude Allouez came in 1669, and Joliet and Marquette in 1673. The settlement became an important fur-trading point during this time. De Langlade is said to have done the first actual farming near here in 1745. The region of which Brown County is a part was ceded by France to England in 1760, and by England to the United States in 1783. The white population in 1785, which was largely French or of French descent, was about 50. The first American settlers began coming in from the East about 1816, and a school was established in 1817 and a post office in 1822. The early American settlers located largely around Green Bay, and later a settlement was established near Flintville in the northwestern part of the county. The military road to Chicago was cut through in 1830 and to Fond du Lac in 1832. The Government land surveys were started in 1834.

Brown County was established in approximately its present form in 1851. A large number of immigrants, from the Netherlands, Belgium, and Germany, came in between 1854 and 1857. The Belgians settled in the northeastern corner of the county, and the Hollanders in the Fox River Valley. The Germans occupied a large part of the southern half of the county and much of the northern half. A Danish settlement was established north of Denmark in 1848. Small Norwegian settlements were made southwest of Green Bay in 1850 and later near Shirley. Irish settlements were established in the

[4] MARTIN, D. B. HISTORY OF BROWN COUNTY, WISCONSIN; PAST AND PRESENT. 2 v., illus. Chicago. 1913.

town of Holland in 1849, in Rockland in 1850, in Morrison in 1854, and in Glenmore in 1856. Bohemians settled southwest of Denmark and Poles near Pulaski and east of Bellevue after the Civil War. The present rural population consists largely of descendants of the early settlers, although a large number of the descendants of the early American and Irish settlers have moved to other localities. The 1930 census[5] gives the population of Brown County as 70,249, 38.9 per cent of which is classed as rural. The density of the rural population is 51.6 persons a square mile.

The first railroad to Green Bay was built in 1862, but large quantities of lumber and other freight were transported by boat previous to that time. The first sawmill in the county was built in 1809, and the lumber industry expanded until about 1855 and continued on a large scale until a few years after the big fire of 1871. Many sawmills were established near Mills Center, Green Bay, Suamico, and at other points. The fire destroyed about one-third of the standing timber in the northern two-thirds of the county. Much charcoal was produced for the iron smelter in De Pere in the early seventies, and farmers started clearing land on a large scale about that time, much timber being piled and burned to clear the land for cultivation.

Green Bay is the county seat and the principal manufacturing and trading center of Brown County. It is an important lake port. Cargoes are transferred from lake steamers to freight cars and to barge lines that go up Fox River. Much local freight is also carried by lake steamer. Green Bay is also an important jobbing center, and several large warehouses for storing canned vegetables, canned fruits, and other food products are located here. Other manufacturing and trading centers are De Pere, Denmark, Wrightstown, Pulaski, Duck Creek, Suamico, New Franken, Bellevue, Greenleaf, Anston, and Kunesh.

The Chicago & North Western Railway, the Chicago, Milwaukee, St. Paul & Pacific Railroad, the Kewaunee, Green Bay & Western Railroad, and the Green Bay & Western Railroad cross the county. Practically all parts of the county are within 8 miles of a railroad shipping point. The roads are excellent. United States Highways No. 41 and No. 141 cross the county, passing through Green Bay. The trunk roads are of concrete construction, and nearly all the secondary roads are surfaced with gravel or crushed rock.

A large proportion of the farmers have telephones, and one-fourth of them are served by high-tension electric-power lines or have house-lighting plants. Most of the rural public schools are substantial 1 and 2 room buildings. Large parochial schools are located in nearly all the villages.

Brown County is one of the leading paper-manufacturing centers of the United States. There are several large mills for the manufacture of paper and pulp in Green Bay and De Pere and one in Little Rapids. The pulpwood is shipped in from Canada, northern Wisconsin, and Michigan. Other important commodities manufactured here are cheese, butter, flour, canned peas, and other vegetables, sugar from sugar beets, evaporated milk at Denmark and Wrightstown, steel furniture, some wooden furniture, and machinery. Crushed rock is produced for building and road making, and brick and tile are made

[5] Soil survey reports are dated as of the year in which the field work was completed. Later census figures are given whenever possible.

for local use. The county has a large fishing industry, more than a million dollars' worth of fish being sold annually from Green Bay. Cheese is manufactured at small factories in different parts of the county. Two large plants for curing and processing cheese are at Green Bay, also several plants for the manufacture of ice cream and other dairy products. A large number of small factories making miscellaneous articles are in different parts of the county.

CLIMATE

Brown County has a cool humid climate. The rainfall is well distributed throughout the year, and crops seldom suffer from protracted drought. The snowfall is moderately heavy. The mean frost-free period reported at Green Bay is 158 days. The average date of the last killing frost is May 5 and of the first is October 10. Killing frost has been recorded as late as May 30 and as early as September 16.

The summer nights are comfortably cool but are not favorable for producing ripe corn of the common varieties. The climate is very favorable for the production of corn silage, small grains, hay, summer garden crops, berries, and apples. Two cuttings of alfalfa, and sometimes three, are obtained in most seasons. Work in the fields is started early in April, and plowing continues until the first part of November.

Table 1, compiled from records of the United States Weather Bureau station at Green Bay, gives the more important climatic data for Brown County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Green Bay, Wis.*

[Elevation, 617 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1895)	Total amount for the wettest year (1914)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	22.3	52	−21	1.81	1.78	0.99	10.1
January	15.3	51	−36	1.69	1.96	.91	13.1
February	17.4	59	−33	1.60	.74	.83	11.8
Winter	18.3	59	−36	5.10	4.48	2.73	35.0
March	28.6	82	−23	2.40	.41	.87	8.0
April	43.2	85	11	2.44	1.21	2.75	2.9
May	54.9	91	26	3.57	4.28	4.42	.2
Spring	42.2	91	−23	8.41	5.90	8.04	11.1
June	62.9	100	34	3.55	2.37	8.68	.0
July	70.0	101	43	3.51	1.44	4.25	.0
August	67.7	98	38	3.10	3.71	5.26	.0
Summer	66.9	101	34	10.16	7.52	18.89	.0
September	60.4	95	25	3.12	1.24	4.86	.0
October	48.5	84	8	2.37	.40	1.73	1.1
November	34.0	69	−12	1.96	1.50	1.78	5.8
Fall	47.6	95	−12	7.45	3.14	8.37	6.9
Year	44.0	101	−36	31.12	21.04	38.03	53.0

AGRICULTURE

The Indians were cultivating numerous areas in the Fox River Valley when the region was first visited by white men in 1634. At that time a camp of about 15,000 Indians near the present site of De Pere, cultivated (in a primitive way) rather large areas. Some areas of soil, slightly darker than typical, probably mark the locations of these old clearings.

The first farming by white men was done by Charles de Langlade in 1745. Farming by white people increased very slowly during this early period and was carried on only by a few French pioneers. The migration from the Eastern States to the region started about 1816. The efforts of these settlers were concentrated on lumbering, but the area of cultivated land was increased steadily, in order to provide food products for home use. A rapid increase in the cleared areas began about 1848 when a large number of foreign immigrants began to enter the county.

The census of 1880 reports 66.8 per cent of the county in farms and 50.1 per cent of the farm land as improved land. The cultivated area increased steadily until 1930 when 87.3 per cent of the county was included in 3,076 farms, and 69.7 per cent of the farm acreage was listed as improved land. Since 1920, much heavy land has been cleared and some sandy land has been abandoned.

Table 2 gives the acreage and yield of the principal crops in Brown County since 1879, as reported by the census.

TABLE 2.—*Acreage and production of principal crops grown in Brown County, Wis., in stated years*

Crop	1879		1889		1899		1909		1919		1929	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Oats	12,690	353,048	28,367	985,043	46,206	1,561,420	43,707	1,421,975	40,762	1,080,981	41,125	1,310,555
Wheat	23,579	319,915	19,045	296,481	24,191	362,410	3,099	47,569	11,272	132,191	1,573	28,355
Barley	2,022	47,011	2,537	63,828	5,345	142,350	13,067	334,680	10,907	229,691	16,856	464,252
Rye	2,862	44,357	9,901	192,594	7,215	124,310	10,310	169,765	9,121	126,731	2,358	41,566
Corn	2,395	74,994	2,243	71,970	4,778	153,560	5,511	151,402	4,333	160,936	1,009	36,704
Potatoes	------	161,344	2,955	222,091	2,481	207,621	4,051	389,048	3,373	328,650	2,732	239,871
Peas, dry	------	30,316	------	42,500	3,261	47,208	4,192	53,441	2,547	34,143	551	10,017
		Tons		*Tons*		*Tons*		*Tons*		*Tons*		*Tons*
Hay	21,999	19,133	35,108	43,023	41,221	51,890	57,626	86,166	70,349	97,739	70,019	126,836
Silage crops	------	------	------	------	------	------	------	------	10,663	105,626	15,572	134,857
Forage, coarse	------	------	------	------	1,451	7,246	5,100	25,003	4,578	4,866	2,441	------

Most of the farmers practiced grain farming from 1850 to 1880, and wheat was the most important crop reported in 1879. Farmers began changing rapidly to a diversified system of farming during the next decade, and general farming, combined with dairying, is the system practiced at the present time.

Comparatively little commercial fertilizer has been used in the county in the past, but its use has increased rapidly in the last few years. The census reports $19,647 expended for fertilizer in 1929, which included considerable limestone. Ready-mixed fertilizers are commonly used, the most popular mixtures being 2–12–2 [6] and 4–6–4. Some 3–12–12 is used on the sandy soils near Suamico.

[6] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

The census reports $347,805 expended for feed in 1929. Much of this is restored to the soil in the form of manure, all of which is carefully saved.

Most of the farm work is done by the farmer and members of his family. About half the farms reported an expenditure for labor in 1929, averaging $314.18 a farm. The common farm wages are about $50 a month with board, except during the harvest season when wages are higher.

The most popular sized farm in the county is about 80 acres, but where much waste land occurs the farms are larger. Many 40-acre farms are in the northeastern part of the county. The average size of farms has increased from 73 acres in 1880 to 96.1 acres in 1930, and the present tendency is to consolidate the smaller farms into larger units.

The number of owner-operated farms has always far exceeded the number operated by tenants. The percentage operated by tenants has increased gradually from 5.3 per cent in 1880 to 9.9 per cent in 1930. Only 12 farms were operated by managers in 1930. In tenant farming the common practice is for a young man to rent a farm a few years until he has saved enough capital to stock a farm and make a down payment on the land. Probably 56 per cent of the tenants rent for cash. A common rent for an 80-acre farm and buildings is $400 or $500 a year. Another common system of tenancy is for the owner to furnish the work animals, implements, and seed, and the proceeds are divided evenly between the tenant and owner. When the tenant furnishes the work animals and implement he receives about two-thirds of the proceeds.

On most farms, the buildings are large and substantial and the fences are well kept. The dairy barns are commodious and are kept well painted. About two-thirds of the farmers have silos, 1,894 silos being reported in the county in 1928. The work horses are large and well bred. About one-fourth of the farmers own tractors, but most of the farm machinery consists of small 2-horse implements. Nearly all the milk cows are good grades. Holstein-Friesians are most common, but Guernseys are gaining in popularity, and some Brown Swiss, Jerseys, Ayrshire, and milking Shorthorns are kept by some farmers.

Dairying is the main agricultural industry in Brown County. The greater part of the hay, grain, and fodder grown in the county is fed to dairy cows, and a large amount of additional feed is shipped in every year. The Wisconsin Statistical Atlas[7] reports about 47,000 cattle in Brown County, in January, 1928, of which 34,100 were producing dairy cows. That is, an average of 10 producing dairy cows were on each average-sized (87 acre) farm in the county. The milk production for 1927 is stated as 1,932,300 hundredweight, having a farm value of $4,096,476. A large part of the milk is delivered to crossroad factories that make cheese and butter. The milk sold is utilized as follows: By cheese factories, 49 per cent; by creameries, 28 per cent; by condensaries, 9 per cent; by city markets, 3 per cent; cream shipments, 4 per cent; and other uses, 7 per cent. From the milk sold, 9,785,507 pounds of cheese, 5,090,655 pounds of creamery butter, and 12,258,085 pounds of evaporated milk were manufactured in 1927. Considerable income is obtained from surplus cows and veal calves. Very few beef cattle are raised in the county.

[7] EBLING, W. H. WISCONSIN AGRICULTURE, A STATISTICAL ATLAS, 1926–1927. Wis. Dept. Agr. Bul. 90, 102 p., illus. [1928.]

Hog raising is not a very important industry, because little corn is grown here. According to the 1930 census, the number of swine in Brown County on April 1 of that year was 3,989, with a farm value of $201,453. Nearly all farmers raise one or more litters of pigs each year.

The number of sheep in the county on April 1, 1930, was only 2,239.

Practically all farmers raise some chickens, and many specialize in chickens. The number of all chickens on April 1, 1930, was 179,502. The production of eggs in 1929 was 1,304,421 dozens with a value of $378,282, an average of more than $100 a farm.

The beet-sugar factory near Green Bay and the numerous canning and sauerkraut factories represent industries closely related to the agriculture of the county, as they furnish markets for local farm products.

Crop rotation is practiced by most of the farmers of the county. A common 4-year rotation consists of oats or barley, followed by clover and timothy for hay, clover and timothy pasture, and corn or other cultivated crops on about half of the pasture land, the other half being seeded to a small-grain crop. Sometimes the timothy is left in pasture the third year. Two grain crops sometimes follow one another.

The ground is flat broken in the early fall, if possible, and much of it is worked down with a spring-tooth harrow or disk, either in the fall or spring, to kill weeds, and it is harrowed in the spring before seeding.

Manure is spread as fast as produced, when possible, and it is usually applied to the land intended for corn or oats.

The acreage in alfalfa and sweetclover has increased during the last two years. Alfalfa is used for hay and sweetclover for pasture. The fields are usually kept in alfalfa for four years or longer unless the crop freezes out.

Most farmers devote small acreages to special crops, such as green peas for canning, sugar beets, and cabbage.

Cooperative experiments with the farmers by the department of soil extension of the University of Wisconsin have indicated that the use of superphosphate (acid phosphate) has caused a profitable increase of all crops on most of the soils in the county, but especially on the sandy soils. The use of potash has caused a profitable increase on the more sandy soils but not on the clay loam soils. Most soils in the county have a rather high lime content especially in the lower part of the subsoil, but an acre application of about 2 tons of lime has proved profitable for alfalfa and clover on most soils.

A fertilizer high in phosphorus, such as a 2–12–2 or 4–16–4 mixture, is recommended for the heavier soils. The nitrogen is more cheaply obtained by growing legumes. A fertilizer containing more potash, such as a 2–12–16 or 2–8–7 mixture, is recommended for the more sandy soils. Potatoes, especially, need a fertilizer high in potash.

The most popular variety of corn grown in the county is Wisconsin No. 12 (Golden Glow). Some Southern Red Cob is grown for silage. Some Wisconsin No. 7 (Silver King), Longfellow Flint, Northwestern Flint, Wisconsin No. 8, and Wisconsin No. 25 are grown.

The common varieties of oats are Wisconsin No. 1 (Sixty-day), Silvermine, Wisconsin No. 5, Swedish Select, and Kherson. The Forward variety is becoming popular as it outyields other varieties. Much of the oats grown is of no special variety.

Oderbrucker is the most popular variety of barley. Velvet, a new smooth-bearded variety, is becoming popular because it is easy to handle and outyields other varieties by about 3 bushels an acre.

Marquis is the most popular spring wheat, and Turkey and Ashkof are the most popular winter varieties.

Montana and Grimm are the most commonly grown varieties of alfalfa. Some Idaho and a small quantity of Yellow Cossack are grown. White sweetclover is grown.

Marrowfat, Canadian Yellow, Alaska Perfection, and Advancer are the varieties of peas commonly grown for canning. The Scotch and Green varieties are grown for dry peas. Rural New Yorker, Early Ohio, and Irish Cobbler are the most popular varieties of potatoes. The cabbage grown is largely Copenhagen and Glory of Enkhuizen. Wealthy, Duchess, McIntosh Red, Northwestern Greening, and Fameuse (Snow) are the common varieties of apples. Montmorency and Early Richmond are the favorite varieties of cherries grown.

SOILS AND CROPS [8]

Most of the typical well-drained soils in Brown County have light grayish-brown topsoils and red or brown subsoils. The poorly drained or bottom soils have darker surface soils and mottled or gravelly subsoils. A large number of soil types occur in the county. They differ from each other most conspicuously in the texture, or relative heaviness or coarseness of the surface soil and subsoil, in the content of gravel and rock, and in surface slope and drainage.

For agricultural purposes the soils of the county may be classified as follows: (1) Well-drained soils with heavy subsoils, (2) poorly drained mineral soils, (3) well-drained sandy soils, (4) stony soils, and (5) organic soils.

The first group includes the Kewaunee, Superior, Onaway, Bellefontaine, and Fox soils and covers 67 per cent of the area of the county. They are the dominant agricultural soils and have had the most influence in determining the type of agriculture practiced. About 80 per cent of these soils is cultivated. The lower subsoil layers of all the soils of the group are rich in lime, but the topsoils and upper subsoil layers are slightly acid or neutral.

The Kewaunee soils have light grayish-brown topsoils and dull-red stiff heavy clay subsoils containing some gravel and bowlders. Surface drainage is very good over these soils. They cover 192 square miles, most of which lies in the southeastern half of the county. The Superior soils have light grayish-brown topsoils and dull pinkish-red subsoils free from gravel and bowlders. They are nearly level and have fair surface drainage. They cover 95 square miles, mainly in the Fox River Valley. The Onaway (Superior) soils have light grayish-brown topsoils and brownish-red or pinkish-red friable clay subsoils. They vary greatly in texture. They occupy nearly level

[8] Some discrepancies appear to exist in the joining of soils along the boundaries between Brown County and adjoining counties. These minor changes are owing to changes in nomenclature, correlation, and accuracy of mapping soils as the soil-survey work progresses.

or gently rolling land and are fairly well drained. They cover 30.6 square miles in the northwestern part of the county. The Bellefontaine soils have light grayish-brown smooth friable topsoils and reddish-brown gravelly clay subsoils. The areas are gently rolling and are well drained. These soils cover 33.4 square miles in the southeastern corner of the county. The Fox soils have gravelly sandy clay rather than heavy clay subsoils but may be included with this group because of similar agricultural value.

The soils of the second group, the poorly drained mineral soils, are the Poygan, Maumee, and Granby soils. They include a wide variety of soils but cover only 14.3 per cent of the county. They have poor natural drainage but are productive when drained. About one-third of their area has been drained and is now cultivated.

The Poygan soils have black or dark-brown topsoils and mottled pinkish-red heavy clay subsoils. They occupy depressions within areas of Kewaunee soils. The Maumee soils have nearly black or very dark brown topsoils and sandy subsoils. They occupy level swales and flats, usually near streams. The Granby soils have dark-brown sandy topsoils and mottled yellow, gray, and pink sandy subsoils that are rich in lime. They are underlain by red clay at a depth ranging from 3 to 10 feet. Included with the poorly drained mineral soils are the soils of the stream bottoms, subject to overflow. Of these, the Ewen soils have medium-brown topsoils and red clay, stratified with sand and gravel, subsoils, and the Genesee soils have medium-brown topsoils and mottled brown and gray clay, stratified with sand and gravel, subsoils.

The third group, or the well-drained sandy soils, includes the Coloma, Plainfield, and Berrien soils. Ottawa loamy fine sand (Superior fine sand), a minor soil type, may also be included with this group. Soils of this group cover 5.7 per cent of the county.

The Coloma and Plainfield soils have brownish-gray sand topsoils and grayish-yellow sand subsoils. The Coloma soils cover rolling areas, and the Plainfield soils occur in level benchlike areas. They are very acid and of low agricultural value. The Berrien soils have light grayish-brown topsoils and yellow or somewhat pink mottled subsoils with a pink clay substratum beginning at a depth ranging from 5 to 12 feet. The topsoils are nearly neutral, and the subsoils are rich in lime. These soils occur on flat areas, but they are fairly well drained. They are moderately productive when properly fertilized.

The fourth group consists of soils with slight depth to bedrock or a high rock content. It includes the Longrie and Posen soils and rough broken land. The Longrie soils are on the level areas of "flat-rock" land having a shallow covering of soil. The Posen soils are a mixture of bowlders, gravel, and soil. Rough broken land is more or less rocky and is too steep for cultivation. Areas mapped as the deep phase of Longrie stony loam are largely cultivated, but the other areas are used for pasture and wood lots. Soils of this group cover 3.5 per cent of the county.

The fifth group, or organic soils, includes the areas mapped as muck and peat, which occur in low basinlike areas scattered over the county and on flat areas along Green Bay. The organic soils are lower and wetter than the poorly drained mineral soils. Very few areas are farmed, as they are of low agricultural value even when drained.

In the following pages of this report the soils of Brown County are described in detail and their agricultural importance is discussed; their location and distribution in the county are shown on the accompanying soil map; and their acreage and proportionate extent are given in Table 3.

TABLE 3.—*Acreage and proportionate extent of soils mapped in Brown County, Wis.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Kewaunee silty clay loam	89,728	26.5	Granby fine sandy loam	4,992	1.5
Kewaunee silt loam	12,288	3.6	Ewen silty clay loam	8,512	2.5
Kewaunee loam	7,616	2.3	Genesee loam	4,416	1.3
Kewaunee fine sandy loam	13,248	3.9	Berrien loamy fine sand	6,528	1.9
Superior clay loam	30,912	9.1	Ottawa loamy fine sand (Superior fine sand)	6,592	2.0
Superior clay	12,672	3.8	Coloma fine sand	4,288	1.3
Superior silt loam	7,872	2.3	Plainfield fine sand	1,792	.5
Superior loam	3,840	1.1	Longrie stony loam	2,752	.8
Superior fine sandy loam	5,504	1.6	Longrie stony loam, deep phase	1,920	.6
Onaway loam (Superior loam)	10,304	3.1	Posen loam	2,048	.6
Onaway silt loam (Superior silt loam)	9,280	2.7	Posen stony loam	896	.3
Bellefontaine silt loam	17,600	5.2	Rough broken land	4,160	1.2
Bellefontaine silt loam, level phase	1,088	.3	Carlisle muck	7,936	2.4
Bellefontaine loam	1,344	.4	Carlisle muck, shallow phase	5,184	1.5
Bellefontaine gravelly loam	1,344	.4	Rifle peat	3,264	1.0
Fox loam	2,432	.7	Tahquamenon peat	1,472	.4
Poygan silty clay loam	27,072	8.0	Tahquamenon peat, shallow phase	1,408	.4
Poygan clay	2,688	.8			
Maumee loam	8,448	2.5			
Granby fine sand	5,120	1.5	Total	338,560	

WELL-DRAINED SOILS WITH HEAVY SUBSOILS

The dominant agricultural soils of Brown County are those which have been included in the group of well-drained soils with heavy subsoils. The Kewaunee, Superior, Onaway, and Bellefontaine soils are different in some respects but are of comparable agricultural value. The greatest difference in these soils is in the texture of the topsoils. All the soils are fairly well drained and have heavy subsoils rich in lime and the other elements necessary for the production of good crops. They retain moisture well and are readily maintained in good physical condition. They have no hardpan to interfere with plant roots or the internal movement of water, and they do not have enough slope to cause excessive erosion.

These soils are especially well adapted to hay, pasture, and small-grain crops, the crops that are necessary to support the dairy industry. They are light-colored forest soils rather low in organic matter and nitrogen, and they need continued applications of manure to replenish the organic-matter content. They are very productive soils but are not so well adapted to continuous corn growing or continuous wheat growing as are the black prairie soils.

The Kewaunee soils are by far the most important of the four dominating soil series in the county, and Kewaunee silty clay loam is the dominant and representative soil of the Kewaunee series. Other types of the Kewaunee series mapped are the silt loam, loam, and fine sandy loam. They differ chiefly in the texture and depth of the surface layer over the red clay. The silt loam, loam, and fine sandy loam are all of comparatively small extent in Brown County.

Kewaunee silty clay loam.—Kewaunee silty clay loam has a light grayish-brown friable silty clay loam topsoil and a stiff dull-red plastic clay subsoil. Virgin areas have a medium-brown surface layer to a depth of about 3 inches, underlain by a yellowish-gray or ash-gray

subsurface layer which extends to a depth ranging from 3 to 7 inches. These two layers become mixed in cultivated areas, and the soil assumes a red shade. The upper subsoil layer is very tenacious dull-red stiff plastic clay, to a depth ranging from 16 to 20 inches, and is somewhat less plastic dull-red clay to a depth of 60 or more inches. It is underlain in most places by dolomitic limestone at an average depth between 30 and 40 feet. The rock outcrops in the northern part of the county and near the Niagara Escarpment, but it may be covered by more than 90 feet of red clay in places to the southeast. Both surface soil and subsoil contain a sprinkling of angular gravel and some bowlders.

The surface is in general undulating or very gently rolling, with just enough slope to afford good drainage, but in a few areas the slopes are steep enough to interfere with cultivation or to cause excessive erosion. Some small areas of Kewaunee silty clay loam have a level surface and somewhat deficient drainage, and bedrock is not far below the surface.

The surface soil and upper subsoil layer of Kewaunee silty clay loam are usually slightly acid to a depth ranging from 16 to 20 inches, but the lower subsoil layer is rich in lime. An acre application of 1 or 2 tons of lime is necessary, in most places, to prepare the soil for alfalfa or sweetclover, but other crops do not need lime.

Kewaunee silty clay loam is well adapted to the common crops of the region. The comparative acreage and average yields are about the same as the average for the county, as indicated by census returns. The proportionate acreage devoted to the different crops is about as follows: Clover and timothy, 40 per cent; oats, 25 per cent; corn, 11 per cent; barley, 10 per cent; wheat, 1.6 per cent; alfalfa, 3 per cent; potatoes, 1 per cent; canning peas, 1 per cent; dry peas, 0.4 per cent; sweetclover, 1 per cent; and sugar beets, cabbage, gardens, orchards, and other crops, 6 per cent.

The average acre yields are about as follows: Clover and timothy hay, 1.54 tons; alfalfa, 2.58 tons; oats, 38.9 bushels; barley, 30.5 bushels; winter wheat, 18.8 bushels; spring wheat, 16 bushels; ear corn, 43.8 bushels; potatoes, 113.5 bushels; canning peas, 20.1 hundredweight; sugar beets, 9.1 tons; and cabbage, 9.8 tons. These yields are the average for the county given by the Wisconsin crop reporting service from 1917 to 1926. The average yields on Kewaunee silty clay loam are probably somewhat higher than the average for the county, especially for alfalfa, clover, and grains.

The relative acreage of the different crops does not vary much on the different soils. A farmer needs a certain amount of hay, silage, pasture, and grain to supply feed for his livestock, and he plants a sufficient acreage of each crop to supply his needs.

Kewaunee silty clay loam is especially adapted to alfalfa, sweetclover, and red clover, particularly when limed. It is not so well adapted to corn, as it is a rather late soil and is rather hard to cultivate.

Unpublished reports of chemical analyses, made by the Wisconsin State soils laboratory, of Kewaunee silty clay loam here and in surrounding counties indicate that the topsoil contains from about 0.1 to 0.19 per cent of phosphoric acid, from 0.04 to 0.075 per cent nitrogen, and from 2.30 to 3.65 per cent total potash. This indicates an exceptionally high content of potash and a moderate amount of nitrogen and phosphoric acid. This agrees with the experience gained

from the use of fertilizers in the field, which has shown that the use of commercial fertilizers containing a high percentage of phosphorus is profitable, especially with corn and alfalfa. An acre application of about 150 pounds in the row with corn or sugar beets and about 300 pounds with alfalfa is necessary to obtain the most profitable results. All the available manure should be carefully conserved to supply the nitrogen. Indications are that the fertility of this soil, with the exception of a small annual loss of phosphorus, is being well kept up under the present system of diversified farming. Where much feed for dairy cattle is bought from outside the county, the supply of phosphorus is apparently being maintained.

Kewaunee silty clay loam is not a desirable soil for garden or truck crops, most of which prefer sandy soils, as it is too cold and too hard to cultivate. Cabbage does fairly well but not so well as on the Onaway (Superior) soils. Apples do exceptionally well.

Sugar beets return good yields, and the sugar content is high. Sugar beets also do well on well-drained areas of the Poygan and Superior soils.

Kewaunee silt loam.—The areas mapped as Kewaunee silt loam have a silt loam topsoil to an average depth of 12 or 14 inches. This is somewhat deeper and coarser than the corresponding layer of the silty clay loam. The subsoil and substratum are essentially similar to the corresponding layers of the silty clay loam.

Kewaunee silt loam is of about the same agricultural value as Kewaunee silty clay loam, but it is somewhat easier to cultivate. It is better adapted to garden crops and corn.

Kewaunee loam.—The topsoil of Kewaunee loam in cultivated areas is grayish-brown or light reddish-brown loam 8 or 9 inches thick. The upper part of the subsoil is in most places reddish-brown loam or silty clay loam to a depth ranging from 16 to 24 inches, where it is underlain by dull-red stiff plastic clay.

This soil is much easier to manage than Kewaunee silty clay loam, but it is harder to work than the average loam soil. Little, if any, commercial fertilizer is used. Most of the fertility removed by crops is returned to the soil in manure. No lime is required on most areas in order to grow alfalfa.

Kewaunee fine sandy loam.—The topsoil of Kewaunee fine sandy loam in most places is light-brown fine sandy loam about 8 inches thick. It grades into brownish-yellow fine sandy loam. At an average depth of about 30 inches the fine sandy loam material is underlain by dull-red stiff plastic clay which continues downward to considerable depth.

Kewaunee fine sandy loam is much better adapted to garden crops than Kewaunee silty clay loam, but it is not quite so good for clover, alfalfa, and grains.

Superior clay loam.—Superior clay loam, the most important of the Superior soils in Brown County, resembles Kewaunee silty clay loam in many respects. Like the Kewaunee soil, it has a light grayish-brown silty clay loam topsoil and a dull-red stiff plastic clay subsoil. It differs in that it is free from gravel and rock in both the surface soil and subsoil. The surface is nearly level instead of gently rolling; drainage is only fair instead of good, and the deeper subsoil layer is pinkish red rather than dull red. In places seams of sand are present in the lower part of the subsoil.

Superior clay loam occupies a total area of 48.3 square miles in Brown County. The relative acreages of the crops grown and the average yields on Superior clay loam are comparable with those on Kewaunee silty clay loam. Yields are about the same in dry years but lower in wet seasons. This soil is poorly adapted to alfalfa which needs a very well drained soil. Apple trees do not thrive so well, but sugar beets, alsike clover, and cabbage do as well, or better, than on Kewaunee silty clay loam.

Superior clay.—Superior clay has a slightly darker, redder, topsoil than Superior clay loam. The topsoil is heavy clay or silty clay, that puddles easily and is very hard to cultivate. All this land is very flat, and drainage is not very good but can be improved by tiling.

The largest areas of this soil lie on each side of Fox River, southwest of Green Bay. In respect to agricultural use, this soil is similar to Superior clay loam, but owing to its heavier texture and slower drainage it is, in general, more difficult to work and not quite so productive as the clay loam.

Superior silt loam.—The topsoil of Superior silt loam is light-brown or brown friable silt loam about 10 inches thick. The upper part of the subsoil ranges from yellowish-brown or yellow fine sandy loam to silty clay loam and is underlain by dull-red or pink stiff plastic clay at an average depth of about 20 inches. The red clay continues to a depth of 48 or more inches and is underlain by stratified layers of sand and clay. The topsoil is slightly acid or neutral and is free from rock and gravel.

Most of this soil occurs in small scattered areas, associated with other soils of the Superior and Kewaunee series. Drainage is fairly good, even though the surface is level. The subsoil was formerly water-logged in many areas, but tile drainage has largely overcome this condition.

Superior silt loam is considered a very good farming soil, and probably 90 per cent of it is now devoted to cultivated crops. The same crops are grown, and generally in the same proportions, as on Kewaunee silty clay loam, but the average yields are slightly lower. This is a much easier soil to manage than Superior clay loam.

Superior loam.—The topsoil of Superior loam is commonly light brown to a depth of 8 or 10 inches, but many virgin areas have a thin dark grayish-brown surface layer. The subsoil is derived from stratified material and is variable in composition. The upper part ranges from reddish-brown or yellow loam to reddish-brown silty clay loam. It continues to an average depth of about 20 inches, where the material usually becomes somewhat finer in texture. The deep subsoil or substratum, below a depth ranging from 20 to 36 inches, is generally dull-red stiff clay, containing gray calcareous mottles, or reddish-brown clay loam, and it is underlain by red clay. Layers of gray fine sand or red clay may be present at any depth in the subsoil. The topsoil is slightly acid.

This soil occurs in small scattered areas in the central part of the county. Most of it is sufficiently well drained to produce the ordinary crops grown in the county. In places some seepage occurs in the subsoil, but this can be overcome by tile drainage. The soil is used in connection with surrounding areas of Superior and Kewaunee soils, under similar management, and similar yields are obtained.

Superior fine sandy loam.—Superior fine sandy loam has a light grayish-brown topsoil to a depth ranging from 12 to 18 inches where it is underlain by pinkish-red or dull-red plastic clay. Layers of fine sand are common in the lower part of the subsoil. Surface drainage is good. This soil is locally recognized as being especially well adapted to truck crops, and probably 10 per cent of it is used for growing such crops.

Onaway loam (Superior loam).—Onaway loam (Superior loam) differs from the Kewaunee soils principally in having a friable clay loam subsoil, rather than a plastic clay subsoil, of a slightly more brown or tan shade. The lower part of the topsoil is more gray than the corresponding layer in the Kewaunee soils.

Onaway loam (Superior loam) has a medium-brown or light-brown surface layer underlain by a gray subsurface layer at a depth ranging from 6 to 12 inches. The subsoil is dull-red or pinkish-red friable clay loam having a characteristic brown or tan shade. The subsoil contains considerable angular dolomitic limestone gravel and some bowlders. It is permeable to water and plant roots and has a good water-holding capacity. The subsoil is rich in lime, and the topsoil is neutral or very slightly acid. Virgin areas have a medium-brown thin surface layer underlain by pale yellowish-brown loam which extends to a depth of about 8 inches where it passes into a yellowish-gray layer continuing to a depth of about 15 inches. The soil contains much very fine sand.

Onaway loam (Superior loam) occurs only in the northwestern part of the county. The relief is generally rolling, and drainage is adequate for cultivated crops. This soil is comparable to Kewaunee silty clay loam in agricultural value. The relative acreages and the average yields are almost as high for most crops.

Onaway loam (Superior loam) is especially well adapted to cabbage, cauliflower, and other truck crops. About 700 acres in the county are annually devoted to cabbage, and about two-thirds of the crop is grown on the Onaway (Superior) soils. The average yield is about 10 tons an acre, but yields of 20 or 25 tons are often obtained. According to the Wisconsin Statistical Atlas, the yield is higher here than in any other county in the State. Sugar beets do not do so well as on Kewaunee silty clay loam. Alfalfa does well, but little is grown at the present time.

Onaway silt loam (Superior silt loam).—Onaway silt loam (Superior silt loam) resembles Onaway loam (Superior loam) except in having a silt loam topsoil. The silt loam also contains considerable very fine sand in the topsoil.

This soil occurs along the western border of the county. The topsoil becomes gradually more sandy toward the east. In its utilization and agricultural value, Onaway silt loam (Superior silt loam) is similar to Onaway loam (Superior loam).

Bellefontaine silt loam.—Bellefontaine silt loam, which is representative of the Bellefontaine soils, in virgin areas has a thin medium-brown silt loam surface layer underlain by light-brown or pale brownish-yellow silt loam. In many places a pale yellowish-gray layer occurs at a depth ranging from 10 to 14 inches. In cultivated areas, the topsoil is grayish brown, and the subsoil is friable reddish-brown gravelly clay to a depth of about 30 inches where it passes into

yellowish-brown gravelly clay. A noticeable characteristic of Bellefontaine silt loam is that the topsoil is very friable and in places is free from gravel, whereas the subsoil is very gravelly. The topsoil and upper part of the subsoil range from slightly acid to neutral, and the lower part of the subsoil is rich in lime. Most of the areas of this soil are gently rolling and well drained, but some areas are very morainic and hilly.

The relative acreages of the crops grown is about the same as on Kewaunee silty clay loam, or the average for the county. The average yields are higher than the average for the county but, for most crops, hardly as high as on Kewaunee silty clay loam. This soil is recognized as being better adapted to corn and garden crops than Kewaunee silty clay loam but does not produce quite such high yields of grain and hay crops, especially alfalfa. It is considered a very fertile soil.

The physical characteristics of this soil are very good, so that it is easy to cultivate. The subsoil has a good water-holding capacity and is permeable to moisture and plant roots. The soil is not quite so drought resistant as Kewaunee silty clay loam, but it produces better crops in wet seasons.

Bellefontaine silt loam, level phase.—The level phase of Bellefontaine silt loam differs from the typical soil chiefly in the level or nearly level surface relief of the areas. This difference in relief is reflected to some extent in the drainage conditions. Run-off is slower from the soil of the level phase, and the tendency to imperfect drainage is more marked. In normal seasons, however, drainage is sufficient for agriculture, and crops and yields are similar to those on typical Bellefontaine silt loam.

Bellefontaine loam.—Bellefontaine loam is of small extent in Brown County. Most of the areas are rather hilly and have a variable topsoil, ranging from heavy gritty loam to fine sandy loam. The soil is less productive than Bellefontaine silt loam. Less than half the area of this soil is cultivated, owing largely to the choppy surface relief.

Bellefontaine gravelly loam.—The topsoil of Bellefontaine gravelly loam ranges from heavy gravelly loam to gravelly sandy loam in texture. The subsoil ranges from gravelly red clay to stratified gravel and sand. This soil, as mapped, includes small areas of Kewaunee gravelly loam and Rodman gravelly loam. Very little of the land is farmed, but it is valuable as a source of gravel for road making and for construction work.

Fox loam.—Fox loam has a topsoil like Bellefontaine loam, but it is underlain by stratified gravel and sand at an average depth of about 20 inches. A layer of reddish-brown clay lies over the gravelly layer. In most places the gravelly substratum extends to a depth of more than 8 feet.

This soil occurs on level well-drained benches, mainly in the southeastern corner of the county.

About 60 per cent of the land is cultivated. Crop yields are lower than the average for the county, owing to the poor water-holding capacity of the subsoil. The best yields are obtained on the heavier-textured areas and the poorest on the sandier areas. Considerable sand and gravel for roads and construction purposes are obtained from the gravel and sand substratum of this soil.

POORLY DRAINED MINERAL SOILS

The poorly drained mineral soils are soils that need artificial drainage in order to be profitably cultivated. They are of two general classes, dark colored and light colored; the dark-colored soils are soils that are wet most of the year; the light-colored ones are soils on stream bottoms that are flooded only in the spring and after heavy rains, and consequently are excessively wet for only short periods.

The dark-colored poorly drained soils include the Poygan, Maumee, and Granby soils. The first-bottom soils included in this group are the Ewen and Genesee soils.

The poorly drained soils are used largely for permanent pasture and wood lots. Most of them are suitable, even when drained, for a smaller variety of crops than the upland soils. They have neutral surface soils and calcareous subsoils in most places.

Poygan silty clay loam.—The Poygan soils are the most important dark-colored mineral soils in the county, and of these, Poygan silty clay loam is the most extensive. It has a dark-brown or black silty clay loam topsoil, a mottled drab, yellow, and brown clay loam upper subsoil layer, and a pinkish-red plastic clay lower subsoil layer rich in lime.

Poygan silty clay loam is a very productive soil when drained, and probably 90 per cent of the land has been or can be sufficiently drained to allow cultivation. This soil is especially adapted to alsike clover, timothy, sugar beets, and barley, but it is too cold for corn. Other grain crops are apt to lodge. The ground water is too close to the surface for alfalfa, even in most of the drained areas.

Poygan clay.—Poygan clay differs from Poygan silty clay loam in having a clay, rather than a silty clay loam, topsoil. About 60 per cent of this soil is farm land, owing to the fact that it is easily drained. It is very hard to till and is largely kept in pasture.

Maumee loam.—Maumee loam has a dark-brown or black topsoil underlain by a mottled rust-yellow sandy subsoil, with layers of clay and a trace of gravel in places. The subsoil varies considerably.

This soil occurs in low level benchlike areas near streams, and it is subject to overflow.

Less than 10 per cent of the land is cultivated. It is hard to drain, owing to the saturated condition of the sandy subsoil and to the difficulty of keeping off overflow waters. Farmers say that it is an unproductive soil even when drained. It is considered more valuable for forestry and pasture than for cultivated crops.

Maumee loam is a rather variable soil. The topsoil in places is black or dark-brown rather coarse mucky loam. The subsoil in most places is slushy and water-logged. A few areas, associated with the Coloma soils near Flintville, are slightly acid, but other areas have a sweet surface soil and subsoil.

Granby fine sand.—Granby fine sand has a dark-colored surface soil and a yellow or pink sand subsoil mottled with gray and rust yellow. Where typically developed, the surface soil is neutral and the subsoil is rich in lime. Northwest of Tremble are a few areas of Dunning fine sandy loam and Dunning loamy fine sand, having acid soils and subsoils, which, on account of their small extent, are included in mapping with Granby fine sand. Granby fine sand occurs in low, poorly drained flats bordering Green Bay.

About 60 per cent of the better-drained areas is cultivated, but very little of the poorly drained land is farmed.

Granby fine sand is fairly productive when drained and properly fertilized. Like most sandy soils it needs a well-balanced fertilizer, such as a 3–12–12 mixture, in addition to manure. A minimum of 200 pounds of fertilizer an acre should be used for corn and 300 pounds for small grains. Corn yields about 7 or 8 tons of silage an acre, oats 25 or 30 bushels of grain, and alsike clover and timothy about 1 ton of hay. This soil is well adapted to corn, oats, and alsike clover and poorly adapted to red clover and alfalfa.

Granby fine sandy loam.—Granby fine sandy loam differs from Granby fine sand in having a rather heavy fine sandy loam or loam surface soil, instead of fine sand. Like Granby fine sand, it is covered with a mucky layer from 1 to 3 inches thick, where undisturbed by cultivation. In crop adaptations and agricultural value, Granby fine sandy loam is similar to Granby fine sand.

Ewen silty clay loam.—Ewen silty clay loam has a medium-brown topsoil and a dull-red or pinkish-red heavy clay subsoil containing layers or seams of sand and gravel. It occurs on stream bottoms where the alluvium has washed down from the Kewaunee, Superior, and Onaway upland soils. This land is usually dry, but it is flooded in the spring and after heavy rains. About 5 or 10 per cent of it is farmed. Floods are difficult to control on the narrow bottoms where this soil occurs, but the land is valuable for permanent pasture and is used mostly for that purpose.

Genesee loam.—Genesee loam has a medium-brown surface soil, and the subsoil consists of stratified layers of fine sand, and sand with occasional layers of clay. The clay layers range in color from mottled drab, gray, and brown to red. Dark-colored layers occur in places in the subsoil. These dark layers constituted the topsoil at one time, but they have been covered by later-deposited sediments.

This soil as mapped includes some spots of dark-colored Wabash silt loam that were too inextensive to map as a separate soil type. Included also with Genesee loam are a few areas of Genesee silt loam, which have a silt loam topsoil and layers of clay in the subsoil. Genesee loam includes some spots of lower wetter soil having a dark-colored topsoil, and some areas having a pinkish-red or dull brownish-red subsoil, like the Ewen soils. These areas occur on narrow bottoms and are cut by stream channels and old meanders.

Genesee loam is used almost entirely for permanent pasture, as it occurs along streams with a high gradient and would be apt to wash away if cultivated. Some small areas are broken occasionally, in order to improve the pasture.

WELL-DRAINED SANDY SOILS

The well-drained sandy soils are composed largely of fine sand or loamy fine sand to a depth of more than 2 feet. The group includes Berrien loamy fine sand, Ottawa loamy fine sand (Superior fine sand), Plainfield fine sand, and Coloma fine sand. Berrien loamy fine sand covers level flats with fair surface drainage, Plainfield fine sand occurs on rather high well-drained benches, and Coloma fine sand and Ottawa loamy fine sand (Superior fine sand) occupy gently rolling or rolling areas.

Berrien loamy fine sand.—In virgin areas the surface soil of Berrien loamy fine sand is medium-brown loamy fine sand to a depth ranging from 4 to 12 inches. Cultivated areas are light grayish brown. In many places a rather dark layer, about an inch thick, containing much organic material covers the surface. The upper part of the subsoil in most places is grayish-yellow material which passes into pale-yellow or rust-yellow loamy fine sand at a depth of about 18 inches. The material becomes more pink with depth and is underlain by pinkish-red clay at a depth ranging from 5 to 12 feet. The fine sand just above the red clay is very slushy and resembles quicksand. A few spots of Granby loamy fine sand are included with this soil as mapped.

Areas of Berrien loamy fine sand, conforming to this description, lie along the west side of Green Bay, north of the city of Green Bay.

This soil has about the same farming value as the Granby soils except that it can be farmed without ditching. It needs a well-balanced fertilizer, in addition to manure, in order to produce profitable crops. It is well adapted to potatoes, rye, cucumbers, and truck crops. Crop yields are about 30 per cent lower than the average for the county.

Ottawa loamy fine sand (Superior fine sand).—Ottawa loamy fine sand (Superior fine sand) has a thin medium-brown surface layer underlain by grayish-brown loamy fine sand which extends to a depth of about 5 inches where the material becomes more yellow. In cultivated areas the surface layer is light grayish brown. Pale-yellow fine sand occurs at a depth ranging from 10 to 28 inches, and a thin layer of red sandy clay, at a depth of about 3 feet, is a striking characteristic of this soil. The underlying material is more sandy. In places the soil is underlain by a deep friable red clay layer at a depth of about 30 inches. The depth of the sandy surface layer differs greatly within short distances, and in places the red clay lies close to the surface. In most places the soil is slightly acid to a depth ranging from 2 to 6 feet, below which it is calcareous.

Most of this soil occurs in a belt parallel to and about 4 miles west of Green Bay.

About 50 per cent of the land is in cultivation to the ordinary crops of the county. The soil is fairly well adapted to rye, corn, potatoes, cucumbers, and other vegetables. When the land is well manured, crop yields are about 15 per cent below the average of the county. A well-balanced fertilizer, such as 3–12–12, is desirable for this soil, in order to produce profitable crops.

Coloma fine sand.—In most places Coloma fine sand consists of loose fine sand to a depth of 5 feet or more. The surface layer is yellowish brown, and the subsurface layer is brownish yellow to a depth ranging from 6 to 12 inches, where it passes into pale-yellow or grayish-yellow loose fine sand. The whole profile is strongly acid (about pH 4.8). The soil is porous, droughty, and rather sterile. Less than 10 per cent of this land is cultivated, but about 15 per cent more was at one time cultivated and has been abandoned. Potatoes, rye, cucumbers, and corn are the favorite crops. The yields of other crops are less than one-half the average for the county. The cultivated areas drift badly. A few typical dune areas of drifting sand are included with Coloma fine sand.

Plainfield fine sand.—Plainfield fine sand resembles Coloma fine sand in soil characteristics. It differs in appearance in having a yellowish ash-gray layer at a depth ranging from 3 to 6 inches, and in having a level surface. This soil includes a few spots of fine sand having a coffee-brown hardpan layer at a depth of about 2 feet.

Plainfield fine sand has about the same agricultural value as Coloma fine sand.

STONY SOILS

The stony soils include the Longrie and Posen soils and rough broken land.

Longrie stony loam.—Longrie stony loam has a 2 to 4 inch surface cover of soil consisting of brown heavy loam or clay loam, overlying reddish-brown clay loam which extends to a depth ranging from 4 to 12 inches, where it is underlain by dolomitic limestone bedrock. Many spots consist of bare rock with no soil on the surface. Areas in which the soil has weathered to a depth of more than 12 inches are mapped as a deep phase.

Longrie stony loam occupies flat areas, and very few bowlders are on the surface. Practically none of this soil is cultivated, as it is not adapted to ordinary farm crops, but it is used in places for growing sour cherries or apples by using dynamite to blow out holes for planting the trees.

Longrie stony loam, deep phase.—Longrie stony loam, deep phase, consists of light-brown or medium-brown silt loam or clay loam to a depth of 4 or 6 inches. This layer is underlain by yellowish-brown or reddish-brown friable clay which continues to a depth ranging from 12 to 40 inches, where it is underlain by dolomitic limestone. The depth to bedrock is slight on the western border of the areas and increases gradually to the southeast. Much rotten limestone and some bowlders are present in the lower part of the subsoil. The topsoil is light grayish brown when cultivated.

About 60 per cent of the land of this phase is cultivated. Areas having more than 2 feet of soil produce good crops, with yields about the same as the average for the county, but the areas with less than 2 feet of soil produce poor crops in dry seasons.

Posen loam.—In cultivated areas Posen loam has a light grayish-brown heavy loam or clay loam topsoil. Virgin areas have a medium-brown surface layer overlying yellowish-brown material which passes into a yellowish ash-gray layer at a depth ranging from 5 to 10 inches. The soil has a large content of angular limestone rock and some gravel. Most of the surface rock, which was on the tilled areas, has been hauled off. The subsoil is dull brownish-red gravelly clay containing many bowlders, at a depth of about 2 feet, and a mixture of yellowish-gray gravelly clay and angular bowlders, at a depth ranging from 3 to 10 feet. Bedrock occurs at a depth ranging from 10 to 15 feet.

The cost of clearing this land is great. The cleared areas are surrounded by rock fences 4 feet high and from 2 to 6 feet wide. When cleared the land produces good crops, with yields the same as the average for the county.

Posen stony loam.—Posen stony loam resembles Posen loam, but it is more stony, the surface being almost carpeted with bowlders. About 50 per cent of the surface soil and 65 per cent of the subsoil

consists of angular glacial bowlders. This soil covers an aggregate of 1.4 square miles in the northeastern corner of the county. It is used for wood lots and pasture.

Rough broken land.—Rough broken land includes steep slopes and rough stony land unfit for cultivation. Such land is of very small extent in Brown County, being confined to escarpments along Green Bay and Fox River, the Niagara Escarpment, and a few broken areas dissected by small tributary streams.

ORGANIC SOILS

Three types of organic soils are recognized in Brown County—Carlisle muck, with a shallow phase, Rifle peat, and Tahquamenon peat, with a shallow phase.

The organic soils in this county are, in general, neutral or slightly acid in reaction. The mineral soil underlying the organic soil resembles the subsoil of the poorly drained mineral soils in the surrounding region. The large areas of organic soils surrounded by Bellefontaine soils are underlain by mottled drab friable clay, the areas surrounded by Kewaunee soils and those near Green Bay are underlain by pink stiff clay, the areas in sandy regions are underlain by sand, and the areas near streams have a variable substratum.

Carlisle muck.—Carlisle muck is predominantly very dark brown or black well-disintegrated muck to a depth of 36 or more inches. In places it contains layers of brown peat. This muck appears to be derived from wood and sedge material, and it contains possibly from 10 to 25 per cent of mineral matter.

Less than 1 per cent of this land is cultivated, and the yields are generally low. The cleared areas are used mainly for hay and pasture.

Carlisle muck, shallow phase.—The shallow phase of Carlisle muck is somewhat more desirable for farming than the deeper areas, owing to a higher content of mineral matter and the presence of the mineral substratum at a depth of 20 inches or less. This shallow type of muck makes good pasture land after it has been drained.

Rifle peat.—Rifle peat is largely brown peaty muck to a depth of 36 or more inches. Layers of light-brown material are common. This peat contains some fine fibrous material and wood fragments, indicating its origin. It appears to be derived from partly disintegrated woody material, sedges, and reeds. This type of organic soil resembles Carlisle muck except in being lighter colored, more fibrous, and containing, in most places, less mineral soil. It is of slightly lower agricultural value than Carlisle muck.

Tahquamenon peat.—Tahquamenon peat consists of dark-brown fibrous half-rotted material derived largely from the present vegetation. It occurs in open marshes covered with shallow water and supporting marsh grass, reeds, and cattails. Most of it occupies low flats bordering Green Bay.

Tahquamenon peat, shallow phase.—Nearly half the Tahquamenon peat mapped in Brown County is of the shallow phase. This phase is like the deeper Tahquamenon peat, but it is underlain at a depth of about 2 feet by fine sand which, in turn, is underlain by heavy pinkish-red clay at a depth of 3 feet. None of this soil is cultivated. Considerable wild marsh hay is harvested in years when the water in Green Bay is low. No marsh hay was cut in the year of this survey (1929), as the water was very high.

SOILS AND THEIR INTERPRETATION

The soils of Brown County are classed in the broad group of soils of the United States known as the gray-brown podzolic soils. Most of the soils of the county are podzolic, and a few small spots of sandy soil in the northwestern part of the county are true podzols. The soils mapped are characteristic of soils developed in a cool humid climate with a moderate rainfall. The predominating soils are developed under forest cover from highly calcareous material.

The county lies within the physiographic division covered by the late Wisconsin glaciation. The relief is largely that of a gently rolling till plain.

The parent material from which the soils are derived consists largely of glacial débris deposited at a very recent glacial period. Even the most mature soils of the county are so young that the calcium carbonate has been leached to a depth of only about 2 feet in the heavier soil materials.

Owing to the extreme youth of the region, the difference in the parent materials of the soils has had an unusually strong influence on the development of different soil profiles within the county. Soil profiles that are strikingly similar in the A horizons have been developed on the different well-drained soils, although they are derived from a variety of parent materials.

A generalized profile which shows the common characteristics of the well-drained soils of the county follows:

A_0. A thin film of leaf mold which is missing in burnt-over areas.
A_1. A medium-brown eluviated horizon about 2 or 3 inches thick. In most places the pH value is between 5.8 and 6.9.
A_2. A light-brown, yellowish-brown, or grayish-brown transitional horizon which is missing in many places.
A_3. A yellowish-gray horizon between depths of 6 and 12 inches. The pH value ranges from 5.0 to 6.9. This light-colored horizon is the most conspicuous characteristic of the soils of the county.
B. A dull-red or reddish-brown heavy illuviated horizon between depths of 12 and 28 inches. The pH value in most places ranges from about 6.5 in the upper part to 6.9 in the lower part.
C. The highly calcareous parent material of dull-red or of yellowish-brown glacial débris, or of dull-red water-laid material.

This zonal profile corresponds closely to the profiles of all the well-drained heavier soils of the county and indicates that the soils are podzolic but not true podzols. It lacks the gray layer, or bleicherde, just below the leaf mold, characteristic of the true podzols, and no indurated brown layer, orterde or ortstein, is in the B horizon.

An examination of the soil map of Brown County shows a number of rather definite belts of different soil series extending across the county in a southwest-northeast direction, parallel with Fox River and the Niagara Escarpment.

Beginning at the southeastern corner of the county they are as follows:

1. Bellefontaine soils derived from yellowish-brown gravelly till, in the southeastern corner of the county.
2. Kewaunee soils covering most of the southeastern half of the county.
3. Posen and Longrie soils and rough broken land, which are very rocky soils, in a belt just east of the Niagara Escarpment.
4. Superior soils in a belt about 5 miles wide along Fox River.

5. A belt, about 2 miles wide, of Berrien and Granby soils, occupying a low terrace bordering Green Bay, in which the soils have sandy yellow upper subsoil layers mottled with rust yellow, pink lower subsoil layers, and a pinkish-red clay substratum.
6. An irregular belt of sandy soils, the Coloma and Plainfield fine sands, beginning between the city of Green Bay and Oneida and extending northeastward 2 miles from, and parallel to, Green Bay. Ottawa loamy fine sand (Superior fine sand) represents a gradational soil between soils of this belt and the next belt to the west. These soils have grayish-yellow sandy upper subsoil layers and variable lower subsoil layers. The substratum seems to be partly high sandy terrace or old beach material and partly wind-blown sand over glacial débris.
7. A belt of Onaway (Superior) soils in the northwestern corner of the county. These soils have dull brownish-red friable clay B horizons with a distinct tan shade. The C horizon or parent material is highly calcareous rather loose medium-textured glacial débris.

Many scattered areas of poorly drained soils occur along streams and in local depressions and do not lie in definite belts or strips.

The soils of the area naturally fall into two main groups and several subgroups when considered in regard to soil development. The two main groups are (1) well-drained or moderately well drained soils, and (2) poorly drained soils. The soils of the first group have a fairly definite well-developed soil profile caused by weathering, and the soils of the second group are composed of more or less unweathered material. Both groups are divided into subgroups including soils that have undergone different stages of soil development, owing to differences in drainage, the character and age of the parent material, and vegetation. The dividing line between soils of the main groups is not distinct. Some of the best-drained parts of the more poorly drained soils have nearly as well-developed profiles as the most poorly drained parts of the well-drained soils.

The group of well-drained or moderately well drained soils includes the following subgroups, listed in the approximate order of their maturity:

1A. The Kewaunee group. These are well-drained soils derived from clay till parent material. They have the best-developed profiles of the soils in the county. The Kewaunee, Bellefontaine, Onaway (Superior), Superior, and Fox soils belong in this subgroup. The Superior soils and areas mapped as Bellefontaine silt loam, level phase, do not have as well developed profiles as the other soils of the subgroup. The soil horizons in the Superior soils are somewhat obscured by stratification. Somewhat poorer drainage has retarded the development of a profile in the Superior soils and in the level phase of Bellefontaine silt loam.

1B. The Posen group. This group is composed of well-drained soils having rocky subsoils, the Longrie and Posen soils.

1C. The Coloma group. This group is composed of sandy soils having no illuviated layer, or B horizon, and includes Coloma and Plainfield fine sands. These soils are acid in reaction. Ottawa loamy fine sand (Superior fine sand) is not included with this group because it has an illuviated layer in the B horizon.

The group of poorly drained soils includes the following subgroups:

2A. Ewen group. This group is composed of light-colored soils with stratified subsoils, occurring on alluvial stream bottoms. It includes the Ewen and Genesee soils.

2B. Poygan group. These are dark-colored soils having clay subsoils, the Poygan soils.

2C. Maumee group. This group is composed of dark-colored soils having sandy subsoils, and includes the Maumee, Granby, and Berrien soils.

2D. Organic soils group. This group includes muck and peat.

The Kewaunee group of soils covers 67 per cent of the area of the county. The Kewaunee soils alone cover about 36 per cent of the county. A detailed description is given of a profile of Kewaunee silty clay loam, the most extensive soil type in this group, as observed near Pine Grove, in the NW. ¼ sec. 6, T. 22 N., R. 22 E., in an area of gently rolling well-drained virgin soil, most of which is covered with second-growth white pine. Some glacial bowlders, mostly dolomitic, are scattered over the surface.

A_0. From 0 to three-fourths inch, brown leaf mold, mostly from pine leaves.

A_1. From three-fourths inch to 2½ inches, medium grayish-brown friable clay loam or heavy silt loam of single-grain structure. The material contains no gravel, and it contains considerable undecayed organic matter. It is acid in reaction.

A_2. From 2½ to 7 inches, pale grayish-yellow or yellowish-gray silty clay loam which contains very few root hairs. The material has a faint horizontal or plated structure, is very friable, but is somewhat coherent when moist. The color grades from light gray to reddish gray. No gravel occurs in this layer. The material shows an acid reaction.

From 7 to 9 inches, a transitional layer, in which the material grades from reddish-gray or brownish-gray to brownish-red clay containing much gray infiltrated material and a trace of gravel. The material is acid in reaction.

B. From 9 to 19 inches, dull-red plastic clay, very hard but not tenacious, which breaks up into angular fragments about one-half inch in diameter. Some shading of the gray color is evident. The material contains a trace of limestone gravel and very sharp cornered fragments. It is slightly acid in reaction.

C. From 19 to 42 inches, dull-red plastic clay, but brighter red than the horizon above. The material breaks up into rough cubical fragments about one-half inch in diameter and is not quite so refractory as the material in the horizon above. This layer contains scattered angular gravel, most of which is dolomitic, and some granite. Traces of fine root hairs and roots, traces of worm holes and worm casts, and irregular fish-net cracks, 3 inches apart, occur in the material. The C horizon is the parent material from which the soil has developed. It usually extends with very little change to a depth ranging from 30 to more than 40 feet, where it is underlain by dolomitic limestone. Areas bordering the Bellefontaine soils are underlain in places by reddish-brown gravelly friable clay below a depth of 3 feet.

This profile is representative of virgin areas of Kewaunee silty clay loam in Brown County. The gray subsurface layer is more conspicuous and slightly more acid than in most of the soil. Areas forested with hardwood have a less conspicuous gray layer and are generally less acid in the upper layers. The topsoil of cultivated areas is light gray, with a faint red hue caused by the mixing of the natural horizons. The three other Kewaunee types mapped differ principally in the texture of the A horizon, or topsoil.

The Superior soils resemble the Kewaunee soils in many respects, especially in having red plastic calcareous clay B and C horizons. They differ in being free from rock and gravel, in not being so well drained, and in having less definite horizons. The subsoil is more pink in the Superior soils. The parent materials of the typical Superior soils are laminated, or stratified. In this county, the Superior soils in many places are more calcareous than the Kewaunee soils.

The Onaway (Superior) soils resemble the Kewaunee soils in having red clay B horizons and calcareous glacial till parent materials. The subsoils of the Onaway (Superior) soils consist of brownish-red friable

clay loam instead of dull-red very heavy stiff plastic clay as occurs in the Kewaunee soils. The Onaway (Superior) soils are more calcareous in the C horizon and appear to be younger than the Kewaunee soils.

The Bellefontaine soils differ from the Kewaunee soils most conspicuously in having very gravelly friable reddish-brown B and C horizons instead of slightly gravelly dull-red heavy plastic clay B and C horizons. The Bellefontaine soils have softer, more friable, and silty A horizons. They are characterized by a more rolling relief than the Kewaunee soils. The parent material of the Bellefontaine soils does not effervesce with hydrochloric acid as freely as the C horizon of the Kewaunee soils, although the Bellefontaine parent material contains much more dolomitic gravel. The A horizon of the Bellefontaine soils, however, is usually more nearly neutral than the corresponding layer in the Kewaunee soils. This is probably partly due to the fact that the Bellefontaine soils were originally forested mainly with hardwoods and the Kewaunee soils with white pine. The gray layer in the A horizon is not so conspicuous in the Bellefontaine soils. Bellefontaine silt loam is the predominating type of the Bellefontaine series.

The Fox soils resemble the Bellefontaine soils, but they are underlain by sand and gravel at a depth of about 18 inches.

Soils of the Posen group differ from those of the Kewaunee group in that they are derived from very rocky material which has prevented the development of a normal profile. The Longrie soils are developed from a shallow layer of soil material underlain by shallow dolomitic bedrock, and the Posen soils are developed from very rocky glacial débris.

The soils of the Coloma group have not developed the normal soil profile of the region because they are derived from sandy material. These soils have no distinct horizons except that the topsoil is more brown. Coloma fine sand appears to be derived largely from windblown sand blown up from former high beaches along Green Bay, and Plainfield fine sand covers high terraces, most of the material of which was deposited along Green Bay when the water stood at a much higher level than at present.

The soils of the poorly drained group do not have the normal profile of the region, owing to restricted weathering and recent deposition.

The Ewen group of soils includes light-colored soils developed on stream bottoms. These soils are usually flooded in the spring and after heavy rains but are fairly dry during much of the year. They have little or no development of A and B horizons. The B and C horizons are obscured by stratification. This group includes the Ewen soil and the Genesee soil. Both have light-brown surface soils. The Ewen soil has a red stratified subsoil, and the Genesee soil has a brown, yellow, gray, and rust-brown stratified subsoil.

The soils of the Poygan group have developed dark-colored topsoils, owing to the fact that they are poorly drained throughout the year. This has favored the accumulation of organic material. The Poygan soils have mottled gray heavy clay upper subsoil layers and pinkish-red stiff clay lower subsoil layers. The persistent red color of the lower subsoil layer, even in areas that are always covered with water, is a characteristic feature of these soils.

The soils of the Maumee group differ from the soils of the Poygan group in having porous sandy, rather than clay, subsoils. They are developed on flat terracelike areas. This group includes the Maumee and Granby soils.

Soils of the Berrien series are not distinctly dark soils, but they are included with this group because they have highly calcareous distinctly unleached subsoils. Berrien loamy fine sand has a thin dark-brown surface layer about an inch thick, with a grayish-brown subsurface layer. The upper subsoil layer is grayish-yellow neutral fine sand and the lower subsoil layer is pink highly calcareous fine sand. The soil has no distinct B or C horizons. It differs greatly from the highly leached acid soils of the Coloma group.

The organic soils are separated into types according to the degree of disintegration, source, and depth of the organic layer.

SUMMARY

Brown County, Wis., covers an area of 529 square miles bordering the head of Green Bay. It consists largely of an undulating or gently rolling glacial till plain. The Fox River Valley extends from the head of Green Bay in a southwest direction across the county. The Niagara Escarpment, which extends along the eastern side of the valley of this river, is the most conspicuous topographic feature in the county.

Jean Nicollet first explored the region, of which Brown County is a part, in 1634. It was occupied by French traders until about 1816, when immigrants from the Eastern States began coming in. The present population is composed largely of the descendants of German, Belgian, Dutch, Polish, and other immigrants from western Europe.

Dairy farming is practiced over most of the county. The most important crops are hay, oats, corn, and barley, nearly all of which is fed on the farm. Some feed is shipped in from outside the county. Considerable cabbage and other vegetables are grown for local canning factories and for outside markets. The milk produced is used largely for cheese, but some is used for butter, some for making evaporated milk and other products, and some is shipped as whole milk.

The county is well developed agriculturally. The farm buildings are substantial. The main highways are concrete, and most of the farm roads are graveled.

The soils of the county are broadly classified as gray-brown podzolic soils. They are largely developed from very recent glacial till derived mainly from dolomitic limestone. The lime has been washed out of the topsoil and upper part of the subsoil only, and the lower subsoil layer, in most places, is rich in lime.

Kewaunee silty clay loam is by far the most important agricultural soil in the county. It has a light-brown surface soil and a dull-red highly calcareous heavy plastic clay subsoil. It is a highly productive soil, especially well suited to hay crops and pasture. Smaller areas of Kewaunee silt loam, Kewaunee loam, and Kewaunee fine sandy loam are mapped. All these soils are well drained. They cover much of the southeastern half of the county.

The Superior soils resemble the Kewaunee soils, but they are not so well drained. They are level and free from rock. They are most extensive in the Fox River Valley.

Bellefontaine silt loam covers much of the extreme southeastern corner of the county. It has a light-brown surface soil and a friable brown gravelly clay subsoil. Bellefontaine loam and Bellefontaine gravelly loam are less extensive soils associated with the silt loam.

The Onaway (Superior) soils occur in the northwestern corner of the county. They have light-brown surface soils and dull-red friable clay subsoils. Two types are mapped, the silt loam and the loam.

The Poygan soils are dark-colored poorly drained soils with clay subsoils. They are very productive when drained.

The Maumee soils have dark topsoils and yellow subsoils. They have poor natural drainage but are fairly productive when drained.

The Posen and Longrie soils are stony soils occurring in the northeastern part of the county. The Longrie soils have a shallow covering of soil over shallow dolomitic limestone. Longrie stony loam is not cultivated, but its deep phase is a fairly productive soil when cleared of surface rock. Posen stony loam is nonagricultural. Posen loam is a productive soil when cleared of surface bowlders.

The Coloma and Plainfield fine sands are porous, highly acid, droughty soils of small extent and low agricultural value.

The Berrien and Granby soils are developed in a belt of low terraces on the western shore of Green Bay. They have sandy topsoils underlain by loose sand, which, in turn, is underlain by pinkish-red clay at a depth ranging from 4 to 15 feet. The Berrien soils are fairly well drained and have brown topsoils, and the Granby soils are more poorly drained and have dark grayish-brown topsoils.

Muck and peat occupy numerous poorly drained depressions scattered over the county. Very few areas of these organic soils are cultivated, as they are of low fertility even when drained.

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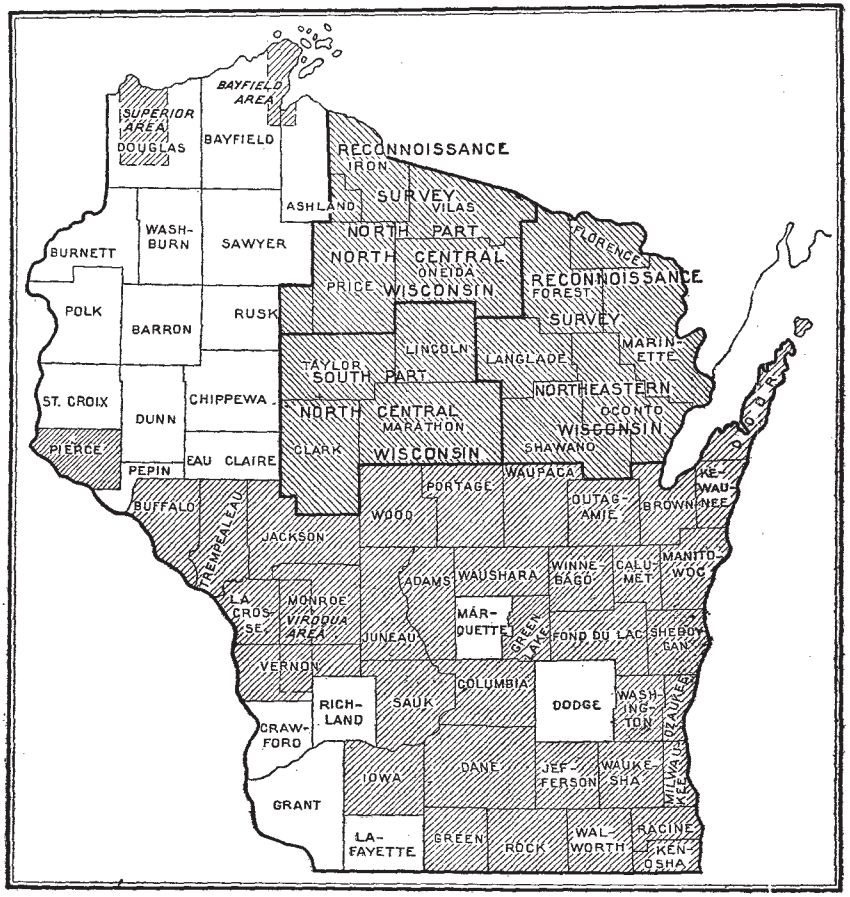

Areas surveyed in Wisconsin, shown by shading. Detailed surveys shown by northeast-southwest hatchings; reconnaissance surveys shown by northwest-southeast hatchings.

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SOIL MAP
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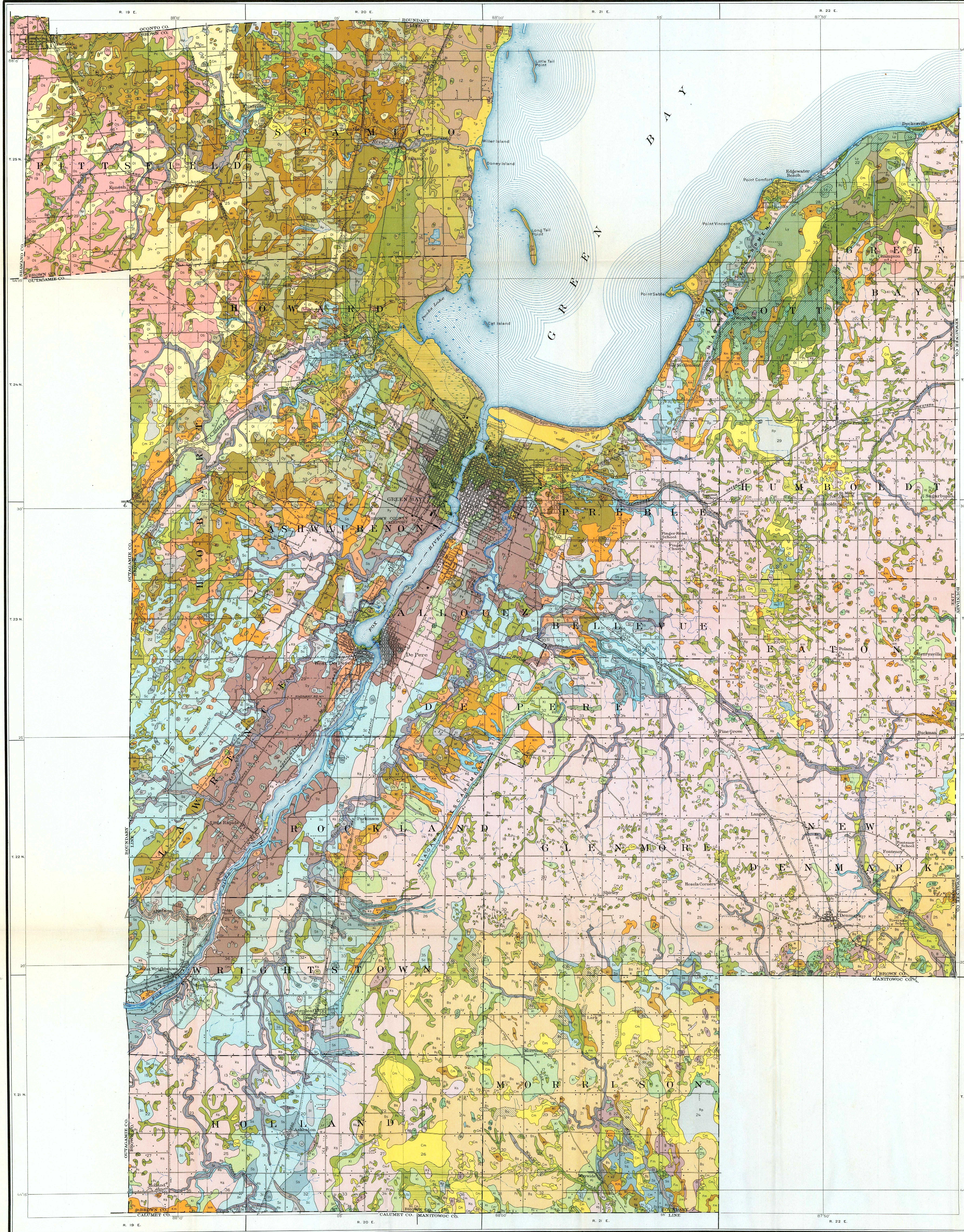

LEGEND

Bellefontaine gravelly loam (Bg)	Maumee loam (Ml)
Bellefontaine loam (B)	Onaway loam (Superior) (Ol)
Bellefontaine silt loam (Bs)	Onaway silt loam (Superior) (Os)
Bellefontaine silt loam, Level phase (Bs)	Ottawa loamy fine sand (Superior) (Oy)
Berrien loamy fine sand (Bl)	Plainfield fine sand (Ps)
Coloma fine sand (C)	Posen stony loam (Po)
Ewen silty clay loam (Ec)	Posen loam (Pl)
Fox loam (Fm)	Poygan silty clay loam (Pc)
Genesee loam (Gl)	Poygan clay (Py)
Granby fine sand (Gr)	Superior fine sandy loam (S)
Granby fine sandy loam (Gf)	Superior loam (Sl)
Kewaunee fine sandy loam (Kf)	Superior silt loam (Ss)
Kewaunee loam (Km)	Superior clay loam (Sc)
Kewaunee silt loam (Kl)	Superior clay (Sy)
Kewaunee silty clay loam (Ks)	Carlisle muck (Cm)
Longrie stony loam (Ly)	Carlisle muck, Shallow phase (Cm)
Longrie stony loam, Deep phase (Ly)	Tahquamenon peat (Tp)
Rifle peat (Rp)	Tahquamenon peat, Shallow phase (Tp)
Rough broken land (Rb)	

NOTE: The names in parentheses are those used in the report published by the State.

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.

Secondary roads, Trails and Power lines — Railroads, Steam and Electric (Double track, Single track, Juxtaposition, In road)

Bridges, Ferry — R.R. crossings, Tunnel (R.R. above, R.R. below)

Ford, Dam — School, Church, Creamery, Cemeteries

Mine or Quarry, Mine dumps, Made land — Bluff, Escarpment, Rock outcrop and Triangulation station

Stony and Gravelly areas — Soil boundaries

Boundary lines (State, County) — Boundary lines (Land grant, City or village)

Boundary lines (Civil township, Reservation) — U.S. township and section lines

RELIEF
(Printed in brown or black)

Contours, Depression contours — Prominent Hills, Mountain Peaks

Sand, Wash, and Sand dunes — Shore and Low-water line, Sandbar

DRAINAGE
(Printed in blue)

Streams — Lakes, Ponds, Intermittent lakes

Intermittent streams — Springs, Canals and Ditches, Flumes

Swamp, Salt marshes — Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

Mark Baldwin, Inspector, District 1.
Soils surveyed by A. C. Anderson, in charge, W. J. Geib and M. J. Edwards, U. S. Department of Agriculture, and M. B. Whitson, C. E. Born, and Harold Bandoli, Wisconsin Geological and Natural History Survey.

Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

LITHO EASTERN OFFSET INC., BALTO.

Field Operations
Bureau of Chemistry and Soils
1929